



# Update

FEBRUARY 1999

## BPAT Process Activated for Hurricane Georges in Puerto Rico.



In response to Hurricane Georges, FEMA deployed a BPAT Preliminary Field Assessment Team (PFAT) to Puerto Rico on Wednesday, September 30, 1998. After a preliminary aerial assessment, a full BPAT was deployed on Sunday, October 4, 1998.

The BPAT performed ground investigations in Puerto Rico, including the islands of Vieques and Culebra. Residential buildings and critical facilities were visited. The team evaluated the performance of both newly constructed and previously existing houses, the majority of which were constructed of concrete and/or masonry. Wood-frame houses equipped with hurricane clips and straps were also evaluated, as were engineered, mid- to high-rise buildings with window protection systems (both shutters and laminated glass).

### Reinforced Concrete Buildings with Concrete Roof Systems

No structural damage was observed in the engineered mid- to high-rise buildings inspected by the BPAT, including those located directly on the shoreline, which are fully exposed to wind moving over the water. These buildings were observed to be new and well-constructed. As engineered structures, they were assumed to meet the current Puerto Rico building code requirement to withstand the forces generated by a 110-mph (fastest-mile) wind.

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Elevated  
Success

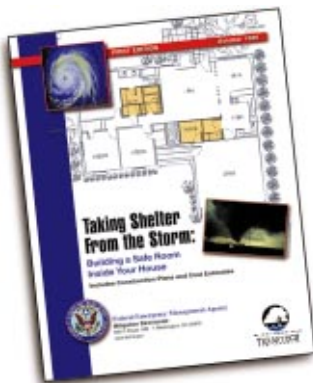
## BPAT Process Activated for Hurricane Georges in the Gulf Coast

In response to Hurricane Georges, FEMA deployed a BPAT Preliminary Field Assessment Team (PFAT) to Pensacola, FL, on Friday, October 2, 1998. Once in the field, the PFAT began collecting information on damage to residential buildings in Alabama, Florida, and Mississippi. Based on the preliminary observations, the PFAT planned an itinerary for an aerial assessment and prepared a mission assignment for a UH-60 Blackhawk Helicopter.

The PFAT flew along the coast from Navarre, FL, to Gulfport, MI. From the air, it appeared that coastal damages were concentrated along the front row of houses along the Gulf of Mexico shoreline. As shown in the photograph above from Dauphin Island, elevated houses on deep pile foundations effectively withstood Hurricane Georges.

A cursory ground assessment in Pensacola Beach showed that although extensive overwash left unelevated buildings flooded and filled with sand, the habitable areas of buildings elevated in accordance with National Flood Insurance Program requirements suffered no flood damage. Wind damage appeared to be limited to asphalt shingle blowoff and

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**Available  
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## **Taking Shelter from the Storm:**

### **Building a Safe Room Inside Your House**

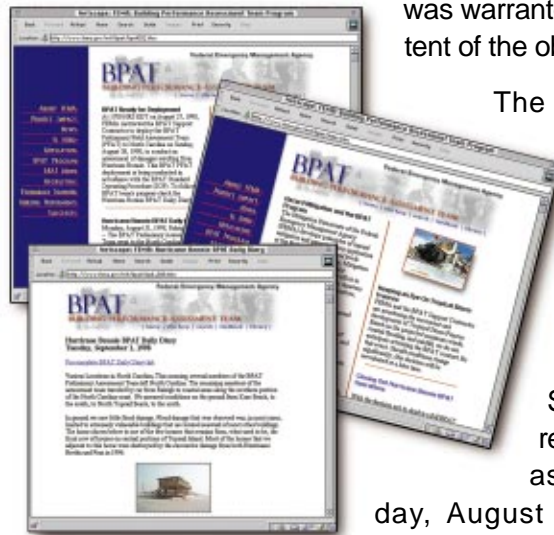
In a joint project with the Wind Engineering Research Center of Texas Tech University in Lubbock, TX, FEMA has produced a booklet for homeowners, contractors, and government officials that provides detailed information about wind hazards and in-residence wind shelters. The booklet explains and illustrates the hazards associated with extreme windstorms such as tornadoes and hurricanes, and it includes wind hazard maps and a worksheet that homeowners can use to assess their risk and decide how best to protect themselves.

The booklet describes wind shelters that can be built into both new and existing houses, including alternative shelter types designed specifically for houses on slab-on-grade, basement, and crawlspace foundations. In addition to shelter descriptions, the booklet includes estimates of shelter construction costs and detailed construction plans that a contractor can use to build a wood-frame, concrete, or masonry shelter designed to resist the forces of extreme winds of up to 250 miles per hour, including the impact of windborne debris. These plans, which can be easily removed from the booklet, include design specifications and lists of all materials required for shelter construction.

***Taking Shelter From the Storm: Building a Safe Room Inside Your House***, FEMA publication 320 (booklet and construction plans), is available from FEMA Publications (1-800-480-2520). The construction plans are also available separately – ask for FEMA publication 320a. The booklet is also available on the FEMA website ([www.fema.gov/mit/tsfs01.htm](http://www.fema.gov/mit/tsfs01.htm)).

# **BPAT Process Activated for Hurricane Bonnie**

On August 25, 1998, in response to Hurricane Bonnie, FEMA activated the post-event phase of the Building Performance Assessment Team process by informing the BPAT Support Contractor, Greenhorne & O'Mara, Inc., that a preliminary field assessment would be conducted. On August 30, 1998, FEMA deployed a Preliminary Field Assessment Team (PFAT) to conduct both ground and aerial investigations of hurricane damage in areas of North Carolina affected by Bonnie. The team's objective was to determine whether deployment of a full BPAT was warranted by the types and extent of the observed damage.



The Preliminary Field Assessment Team coordinated with the North Carolina State Emergency Management Agency and received debriefings from both FEMA and State staff who had already conducted damage assessments. On Monday, August 31, 1998, the team conducted an aerial inspection from a U.S. Army Blackhawk helicopter out of Fort Bragg, NC.

The team flew from Raleigh, NC, to the North Carolina-South Carolina line, then north along the coast to Morehead City, NC, then inland over New Bern and Washington, NC, and finally back to Raleigh. The aerial investigation revealed that the storm damage was not severe. Damage to properly elevated buildings was limited to primarily wind damage to roof coverings (see photograph below). Buildings that were not elevated experienced varying degrees of flood damage, but even that damage was minimal.

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**After the storm passed, FEMA helped homeowners reduce further damage by providing tarps that could be secured over damaged roofs (note blue tarp on house at left).**





## FEMA Partners with the State of Florida to Plan Post-Disaster Assessments

FEMA recently conducted a 2-day workshop with the State of Florida, Department of Community Affairs, Division of Housing and Community Development and Division of Emergency Management, in Tallahassee, FL. The State of Florida is developing a Building Code Triage (BCT) Team process, which is similar to the FEMA BPAT process. The purpose of the workshop was to determine how and to what extent the two post-disaster teams might coordinate and share resources after a disaster in Florida.

The purpose of the BPAT program is to conduct post-disaster assessments of building performance, document failures and successes, and make recommendations for reducing future damage that have broad, national application. The recommendations are aimed at Federal, State, and local agencies; design professionals; organizations dealing with building codes and standards, building science and research, and the production and testing of construction materials; and residents of disaster-affected areas. The BPAT program complements FEMA's *National Mitigation Strategy* and *Project Impact*.

Similarly, the BCT process is aimed at conducting post-disaster assessments that support the Florida Building Code Evaluation process and quickly documenting failures in building construction methods, materials, practices, and standards. BCT Team members would include State personnel, representatives of model building code organizations, and technical experts from various national trade associations and research centers.

In the workshop, FEMA and State of Florida staff presented the objectives, methodologies, potential post-disaster activity time tables, and reporting requirements of the BPAT and BCT Team processes. The workshop concluded with a mock hurricane scenario in which the members of each team discussed the day-to-day operations that would be carried out before and after the landfall of a major hurricane in the State of Florida. From the discussion, the workshop participants identified coordination points between BPATs and BCT Teams.

## FEMA Seeks Conservation Expertise

FEMA and the National Task Force on Emergency Response (NTFER) are recruiting conservation and preservation professionals for post-disaster assistance teams and mitigation research. FEMA intends to create a Cultural Heritage Roster and link it to the existing FEMA BPAT database. The roster will expand the pool of talent and scope of expertise currently available to FEMA.

The NTFER, co-sponsor of the project, is a public-private partnership committed to providing expert assistance to cultural institutions and the public in times of disaster. The task force is an initiative of FEMA, the Getty Conservation Institute, and Heritage Preservation.

In recent years, natural disasters have damaged our Nation's libraries and archives, museums, and historic sites. Finding the proper people for post-disaster deployment teams has sometimes been difficult. The goal of the Cultural Heritage Roster will be to organize the appropriate Federal agency personnel so that they can be mission-assigned by FEMA's Response and Recovery Division. In addition, the roster will include private consultants available for deployment by FEMA and other organizations.

Expertise is needed in a wide range of conservation and historic preservation specialties. Training and/or experience in damage assessment, on-site technical assistance, disaster response and salvage techniques, or disaster recovery practice are preferred. Candidates must be available for temporary field assignments on 48 hour's notice. Both Federal and private sector recruits are eligible for the roster.

If you are interested in becoming a member of the Cultural Heritage Roster, please request an application packet from Eric Letvin, Greenhome & O'Mara, Inc., 9001 Edmonston Road, Greenbelt, MD 20770; phone: (301)982-2800, ext. 611; fax: (301) 220-2606; e-mail: [eletvin@g-and-o.com](mailto:eletvin@g-and-o.com). If you are currently listed in the BPAT database, you do not need to sign up for the Cultural Heritage Roster.

***"BPAT Process Activated for Hurricane Georges in the Gulf", Continued from Page 1***

metal roof peeling. Based on the findings of the BPAT Preliminary Field Assessment Team, a decision was made to deploy a full BPAT team to document hurricane-related damage and building performance success stories.

The full BPAT assembled on October 5, 1998, and was deployed to the field the following day. The BPAT spent 8 days in the field, focusing on riverine and coastal flood damage and wind damage in the affected areas in Alabama, Florida and Mississippi. Some of the observations made by the BPAT in selected communities are presented below.



**Dauphin Island, Alabama** – The BPAT observed widespread damage on the western end of the island that included considerable overwash of floodwaters and sand. Several houses were washed off their foundations. Some of these houses floated into others, causing major damage (see photograph above).

**Baldwin County, Alabama** – The team looked at several residential buildings along the Fish River that were elevated with funds from FEMA's Hazard Mitigation Grant Program. Because they were properly elevated, most of these buildings received minimal or no damage.



**Pascagoula, Mississippi** – The eye of Hurricane Georges came ashore close to Pascagoula; therefore, wind damage in this area was the greatest. The team observed damage to trees, signs, and roofs. Many older houses flooded that were not built in conformance with the



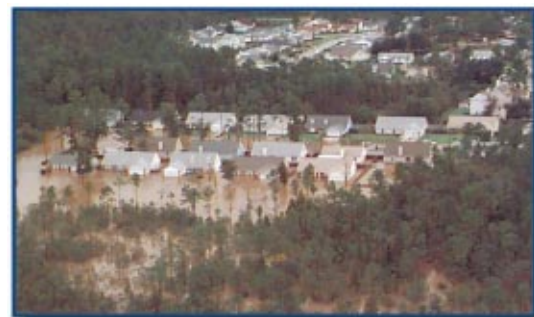
NFIP and local floodplain management requirements. The photograph left shows an example of an older, slab-on-grade house that flooded and also suffered damage to asphalt roof shingles.

**Okaloosa, Santa Rosa, Escambia Counties, Florida**

– The team assessed damage caused by riverine flood waters along the Shoal River that, in many cases, exceeded the Base Flood Elevation by several feet. One neighborhood (shown below) was outside the Special Flood Hazard Area but still suffered flood damage. The damage to these and other buildings demonstrates that structures adjacent to Special Flood Hazard Areas are still exposed to a residual risk of flooding.



After completing the field assessment activities, the BPAT immediately began transferring the knowledge gained in the field to those who would be involved in the post-Hurricane Georges reconstruction activities. Within 2 weeks of field operations, the preliminary findings of the Hurricane Georges Gulf Coast BPAT were presented at the 1998 Florida Home Builders Annual Convention, in Destin, Florida. A half-day educational program was held entitled "Dealing With Disaster: Recovery, Repair, Rebuild." During this session, the Gulf Coast BPAT Leader, Clifford Oliver, of FEMA's Mitigation Directorate, conducted an extensive presentation on building performance along the Gulf Coast during Hurricane Georges.



The preliminary BPAT report is available through the Internet at [www.fema.gov/mit/bpat/rpt.htm](http://www.fema.gov/mit/bpat/rpt.htm). Copies of the final report, after publication in early 1999, can be obtained from FEMA Publications, at 1-800-480-2520. Ask for FEMA publication no. 338.

***"BPAT Process Activated for Hurricane Bonnie", Continued from Page 2***

The subsequent ground investigation confirmed the conclusions that resulted from the team's aerial observations. A consensus was reached among the FEMA Regional staff, State staff, and team members that the damage observed did not warrant the deployment of a full BPAT.

Daily updates of the Preliminary Assessment Team's activities were posted on the FEMA BPAT web page so that all BPAT members could stay abreast of the process. Please check the BPAT web page ([www.fema.gov/mit/bpat](http://www.fema.gov/mit/bpat)) often during major natural disasters to see whether a BPAT has been deployed.





In general, reinforced concrete residential buildings with reinforced concrete roof systems performed extremely well during Hurricane Georges, suffering no structural damage (see the photograph above). A continuous load path from the roof system to the foundation was observed in these buildings.

### Window Protection Systems

Many residential and commercial buildings were equipped with storm shutters of numerous designs and materials. Temporarily installed metal shutters were used with great success on concrete houses throughout the island. In the photograph above, the tracks used to anchor the metal shutters to the house can be seen immediately above and below the windows. The BPAT also observed permanently attached metal rolldown shutters. The small number of these systems inspected were found to have suffered no damage from the hurricane. In addition, the windows of some houses were successfully protected with wooden shutters.



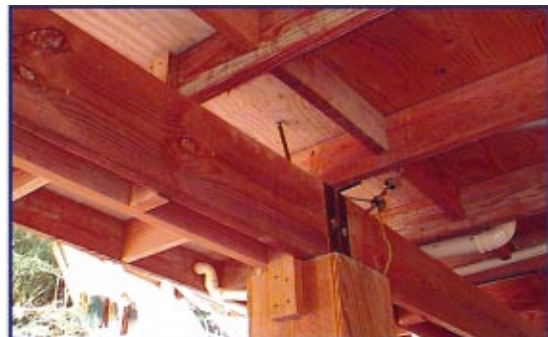
### Clips and Fasteners

In support of repair efforts after Hurricane Marilyn in 1995 and Hurricane Hortense in 1996, FEMA provided hurricane clips and shutters to homeowners on the island of Culebra through the Hazard Mitigation Grant Program. Many of these clips and shutters were observed by the BPAT in its visits to houses on the island. The photograph on the right was taken in a house that was retrofitted with hurricane clips. This house suffered no structural damage during Hurricane Georges.



### Floor Systems/Foundation Connections

Another successful mitigation practice observed on the island of Culebra was the provision of a continuous load path – from the roof to the foundation – in wood-frame houses constructed since Hurricane Marilyn. In addition, some wood-frame houses that lacked a complete



load path still included adequate connections between the floor system and the foundation (see photo above).

### Technology Transfer Begins

After completing the field assessment activities, the BPAT immediately began transferring the knowledge gained in the field to those involved in the post-Hurricane Georges reconstruction activities. On November 5, 1998, a meeting was held at the College of Engineers and Land Surveyors in Halto Rey, San Juan, PR, to discuss improving the sustainability of buildings in Puerto Rico. A presentation of the BPAT observations and recommendations was a starting point for a wide-ranging discussion of building code and code enforcement concerns. Forty-five people were present at this working meeting to support the President's Long Term Recovery Task Force. Present at the meeting were representatives of FEMA, other Federal agencies, and the Government of Puerto Rico. Other mitigation stakeholders in attendance included members of the academic community, practicing design professionals, home builders, and representatives of model building code organizations.

As a direct result of this BPAT, on December 31, 1998, the Government of Puerto Rico issued an emergency regulation adopting the 1997 Uniform Building Code. This action upgraded the existing Puerto Rico building code, which was based on the 1982 UBC.

The preliminary BPAT report is available through the Internet at [www.fema.gov/mit/bpat/rpt.htm](http://www.fema.gov/mit/bpat/rpt.htm). Copies of the final report, after publication in early 1999, can be obtained from FEMA Publications, at 1-800-480-2520. Ask for FEMA publication no. 339.

# YOU Can Become Part of the BPAT Program

## Experts are Needed in the Following Fields:

- Structural and Civil Engineering
- Building Design and Construction
- Coastal Construction
- Flood-, Wind-, and Earthquake-Resistant Design and Construction
- Shoreline and Coastal Erosion
- Building Inspection
- Building Code Development and Enforcement



Are you interested in serving on FEMA Building Performance Assessment Teams or supporting other hazard mitigation activities carried out by FEMA? If you are an expert in one of the fields listed above and can be available for temporary field assignments on short notice, please let us know.

Fill out the form below and return it by mail to:

### ***Greenhorne & O'Mara, Inc.***

9001 Edmonston Road

Greenbelt, MD 20770

Attn: Eric Letvin, or you may fax your information to (301) 220-2606.

Name: \_\_\_\_\_

Expertise: \_\_\_\_\_

Company/Affiliation: \_\_\_\_\_

Street Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone: (     ) \_\_\_\_\_ Fax: (     ) \_\_\_\_\_

### **Federal Emergency Management Agency**

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